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## **Overcoming Plantar Fasciitis**

By **Jen Adley**, LPT

One of the more common overuse injuries, especially associated with running, is plantar fasciitis (PF). Plantar fasciitis is a term used to describe the condition when the 'plantar fascia' of the foot becomes irritated and inflamed, causing discomfort in the heel and arch of the foot. Most people with plantar fasciitis have pain when they take their first steps after they get out of bed, or after sitting for a long period of time. Stiffness and pain tends to decrease after walking a bit, but the foot may hurt more as the day goes on. The condition may be most acute when climbing stairs or after standing in place for a long time.

The plantar fascia is a thick, fibrous band of connective tissue which originates at the heel bone and runs along the bottom of the foot in a fan-like manner, attaching to the base of each of the toes. The plantar fascia takes on a number of critical functions during running and walking. It stabilizes the metatarsal joints (the joints associated with the long bones of the foot) during impact with the ground, acts as a shock absorber for the entire leg, and helps to lift the arch of the foot to prepare it for the 'take-off' phase of the gait cycle.

Although the fascia is a rather tough, resilient structure made up of connective tissue called collagen fibers, it is not immune to injury. Approximately 10% of all running injuries are inflammations of the plantar fascia. In the United States alone this incidence rate would produce about a million cases of plantar fasciitis per year among runners and joggers. People participating in other high impact sports or activities are also prone to plantar problems, as are non-athletic people who spend a lot of time on their feet, the overweight or obese, or those suddenly increasing their level of activity after a long period of inactivity.

The plantar fascia is not very receptive to stretching, and yet stretching occurs in the fascia nearly every time the foot hits the ground. Studies indicate that the fascia can stretch to no more than 102% of its normal length without suffering at least some tearing, but a force equal to almost three times body weight passes through the foot with each step, forcing the fascia to come close to this level. The impact force is increased with running and occurs at a much faster rate- 90 times

per foot, per minute. ('Anatomy and Biomechanics of the Hindfoot,' Clinical Orthopaedics, vol. 177, pp. 9-15, 1983).

It is not surprising that PF occurs fairly frequently in runners. Nor is it a surprise that the damage and pain often occur near the heel where stress on the connective tissue fibers is greatest and where the fascia is the thinnest (it tends to broaden out as it reaches toward the toes). PF is often associated with 'heel spurs'. Heel spurs are an accumulation of calcium deposited at the site where the fascia suffers the most damage. This explains why PF is usually associated with a pinpoint, knife-like pain at the 'medial tubercle' of the calcaneus (heel bone), which happens to be the exact location of the origin of the inside part of the plantar fascia. Swelling may occur just in front of the heel bone, and pain can radiate along the whole longitudinal arch of the foot.

PF is also often associated with:

- A change in training (a sudden increase in the volume or intensity of training, type of training-ie: increase in hill training, or a simple expansion of the total time you spend on your feet)
- Using worn-out shoes, especially while running on pavement or hard ground
- Individuals with flat feet or high arches. SUGGEST: Having flat feet or high arches.
- Gaining weight or being obese- the additional body mass simply places increased stress on the plantar fascia.

If you develop PF, there are certain treatment modalities that can be self-administered; however, it is important to get a proper diagnosis before treating any sports injury.

- Ice - the best method for icing the plantar fascia is to fill up a small plastic water bottle and freeze it. Roll your foot over the ice bottle for 10-15 minutes.
- Rest - if you have a bad case, it may require time off from running, etc. to allow healing as you begin stretching and strengthening.
- Massage - can help loosen up the plantar fascia and improve blood flow.
- NSAIDS (non-steroidal anti-inflammatories)

## **Exhibit B**

- Reduce training load, especially high impact activities
- Strengthening
- Stretching

Although ice, rest, massage, and NSAIDS may help you manage the problem, the only way to truly overcome PF is by increasing the strength and resiliency of the plantar fascia, as well as the other muscles and connective tissues of the foot, and to stabilize and strengthen the entire leg. Otherwise, when you return to full-fledged training, PF is very likely to recur. Overcoming and preventing PF should include regular stretching as well as strengthening throughout the season. The key muscle groups include the hamstrings, gastroc/soleus complex (the calf muscles), the Achilles tendon, and the fascia of the foot.

Tight hamstring muscles (which cross both the knee and hip joints on the back of the leg) can lead to limited extension and exaggerated flexion of the knee during the running stride (they tend to pull the lower part of the leg backward). This over-flexion at the knee actually increases the amount of dorsiflexion at the ankle (lifts the toes) during the landing phase of the running stride. The entire leg functions as a kinetic chain and, if you change one thing (in this case hamstring flexibility), a 'ripple' effect may occur down the leg affecting the ankle joint. Increased flexion of the ankle creates an inordinate amount of stress on the Achilles tendon. The Achilles tendon's 'job' during running is to control dorsiflexion of the ankle, which in turn pulls on the heel bone (calcaneus) and plantar fascia. The hamstrings undergo movement stresses during the running motion and therefore must have flexibility in to avoid overstressing the plantar fasciae.

The Achilles tendon (also known as the heel cord) inserts directly into the heel bone on the back of the foot. The plantar fascia is attached to the heel bone on the underside (sole) of the foot. During the running stride, each component of the body's support system (hip, thigh, lower leg and foot) is responsible for controlling a portion of the impact force associated with landing. Insufficient flexibility in the Achilles tendon during the landing phase can lead to overstress of the plantar fascia. The plantar fascia must then do more than its fair share of the work as the body moves over the foot while the foot is on the ground (a tight Achilles tendon tends to 'throw' the foot forward onto the plantar fascia as impact is made with the ground, increasing the stress on the plantar fascia).

## **Exhibit B**

During a running stride, the plantar fascia undergoes a rather sudden lengthening and then shortening during the landing phase - much like a rubber band that is suddenly stretched and then allowed to shorten. This 'elastic' event requires the plantar fascia to be sufficiently supple and strong to handle such stress without breaking down. Insufficient elasticity in the plantar fascia combined with the tendency to over-pronate (which puts extra stretch on the plantar fascia) is a formula for PF problems. Regular stretching helps the plantar fascia better withstand the key twisting and lengthening forces which are placed on it.

### **Strengthening Exercises**

Strengthening of the entire lower extremity and core will aid in reducing any strength imbalances that may lead to an altered run gait and the many problems that may stem from there. Here we will focus on two strengthening exercises to incorporate into your routine specifically addressing PF.

#### **A. Toe-Walking with Opposite-Ankle Dorsiflexion**

Barefoot, stand as tall as you can on your toes. Balance for a moment and then begin walking forward with slow, small steps (take one step every few seconds). As you do this, maintain a tall, balanced posture. Be sure to dorsiflex (bring foot and toes up) the ankle and toes of the non-stance leg upward as high as you can with each step, while maintaining your balance on the toes and ball of the support foot.

The muscles of the feet require good strength to control the forces associated with landing on the ground during the running stride. This toe-walking exercise helps to develop the eccentric strength and mobility in the muscles of the foot and calf, as well as the plantar fascia and Achilles tendon. The exercise works the foot and ankle through a broad range of motion, especially for the foot which is bearing weight on the ball and toes while the ankle is extended (is in plantar flexion). The exercise also improves balance and stability, which are critical factors for runners hoping to improve their efficiency of movement.

#### **B. Toe-Curls or Toe-Grasping**

To perform this exercise, stand barefoot with your feet hip-width apart. In an alternating pattern, curl the toes of your right foot and then your left foot down and under, as though you are grasping something with the toes of each foot. As you become skilled at this exercise you can grasp as you 'pull' yourself across the

room.

Toe grasping develops strength, coordination and flexibility in the muscles of the foot that run parallel to the plantar fascia and help support the longitudinal arch of the foot. This exercise also strengthens selected stabilizing muscles of the calf and shin. Your range of motion during the 'grasping' action will improve over time, as will the range of motion of the entire foot.

Overall, your strategy should be to strengthen the plantar fascia and related structures in your feet and legs, as well as improve their flexibility in all planes of motion. By doing so, you will take stress off your plantar fascia and be less prone to PF. Keep in mind, though, that if you currently have a tough case of PF, you will need to start slowly with the exercises to avoid aggravating your condition. Icing, anti-inflammatory medications, reduced training, massage, etc. are all good measures to aid healing of PF; however, these measures may not cure the problem. The best way to prevent and treat PF is by increasing the overall resiliency and strength of your legs and feet.

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Published in: [Training News](#)

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